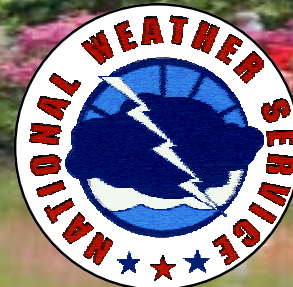


# The Gage

An ABRFC Seasonal Newsletter



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## River Flood Climatologies

By John Schmidt and James Paul

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<http://www.srh.noaa.gov/abrfc>

The ABRFC has been archiving operational data since 1993. During the summer of 2001, we supplemented our archive through the assistance of the Tulsa, Little Rock and Albuquerque United States Army Corps of Engineers District Offices. We now have an archive of six-hourly reservoir pool elevation and river stage data from 1984 to the present. Previous flood climatology presentations have been limited to a forecast point scale. Using ArcView, we were able to interpolate between river forecast points to construct a continuous representation of climatological flood conditions along a river. Using the assumption that the variance of river flooding is linear in nature along a river, our interpolation technique “filled in” missing data. The interpolations were performed on a monthly time step and then aggregated to seasonal and annual maps. A flood day is defined as four six-hourly observations above flood stage in a month. The annual average number of flood days across the ABRFC basin is displayed in the accompanying image (Figure 2). More detailed displays of this data, including County Warning Area (CWA)-specific maps can be found at [www.srh.noaa.gov/abrfc/floodclimate](http://www.srh.noaa.gov/abrfc/floodclimate).

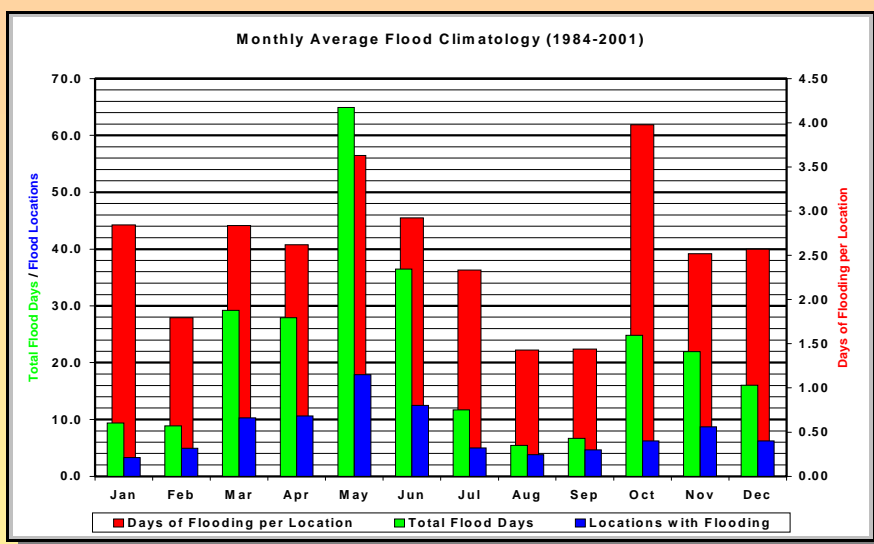
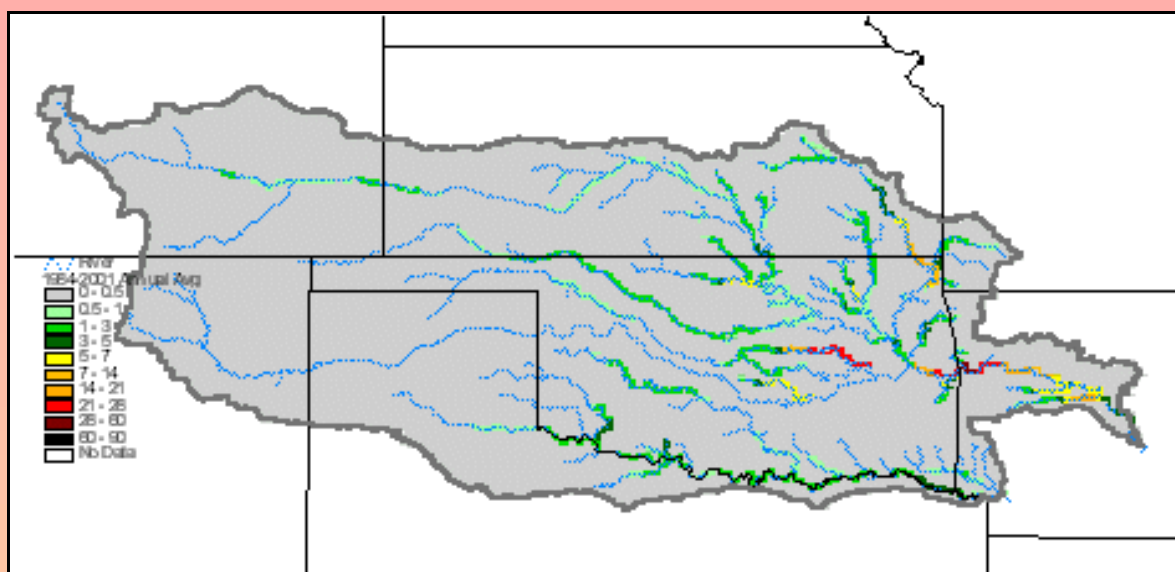


Figure 1. ABRFC Average Monthly Flood Climatology



**Figure 2. Average Annual Number of Flood Days**

## ***ABRFC Water Supply Products***

*By Tracy Howieson*

The ABRFC, in cooperation with the Natural Resources Conservation Service (NRCS), prepares water supply forecasts for selected sites in Colorado and New Mexico. These forecasts are created the first of each month, from January through June. These forecasts determine the total volume of water that could occur at a specific location throughout the forecast time period, April through September in Colorado and March through June in New Mexico. The ABRFC creates several graphic and text products based on these water supply forecasts. Various water supply products are available on the ABRFC web site located at <http://www.abrfc.noaa.gov/pub/WaterSupply>.

The text products that are produced each month include a numeric forecast and a narrative forecast. The numeric forecast lists the most probable volume, reasonable maximum volume, reasonable minimum volume and the percent-of-normal volume for these three categories. These volume forecasts are created for nine sites within the Arkansas River drainage upstream of Pueblo, Colorado and seven sites within the Canadian River basin upstream of Conchas Reservoir in New Mexico. The narrative water supply product gives an overview of the current conditions being observed in the Arkansas River basin. It includes a discussion of the observed precipitation, snowfall and reservoir levels for the past month and for the entire water year.

There are numerous graphic products relating to water supply that are available on the ABRFC web page. These graphics can be grouped into three main categories: forecast, reservoir and precipitation.

The forecast category contains three graphics depicting the water supply forecasts. Two of these graphics display the forecast values compared to the 1971-2000 normal values, one for the Arkansas River and one for the Canadian River. Figure 3 is an example of the February forecast graphic for the Arkansas River. Figure 4 depicts the forecast values supplied by the Ensemble Streamflow Prediction (ESP) model compared to the final forecast value and the 1971-2000 normal.

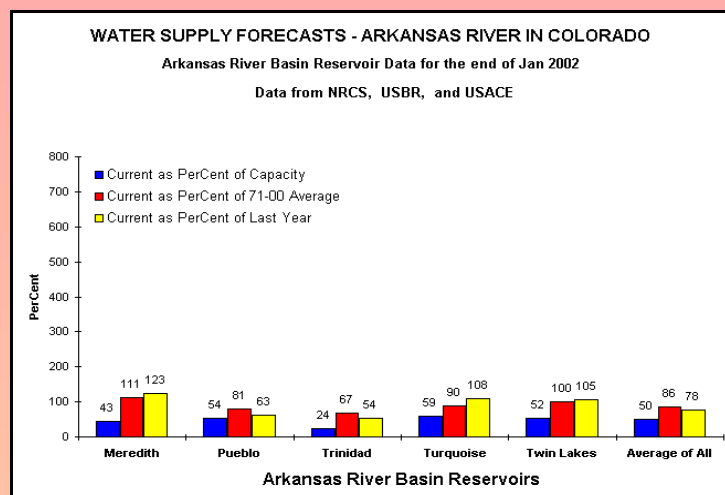
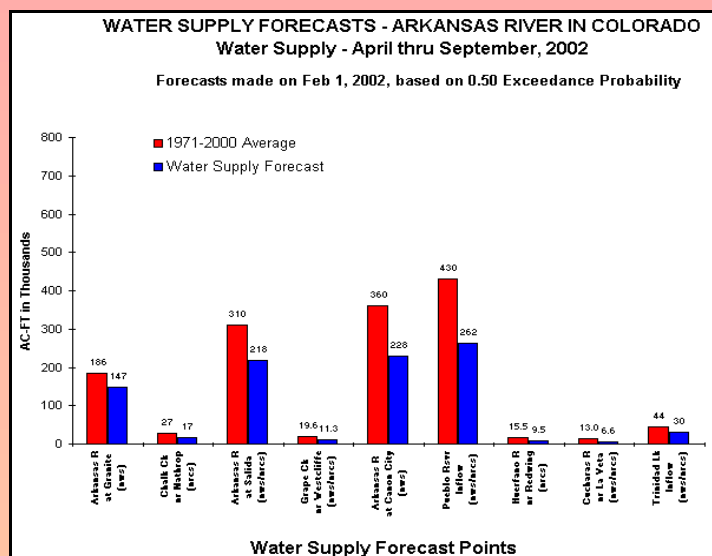


Figure 3. Arkansas River in Colorado Water Supply Forecasts

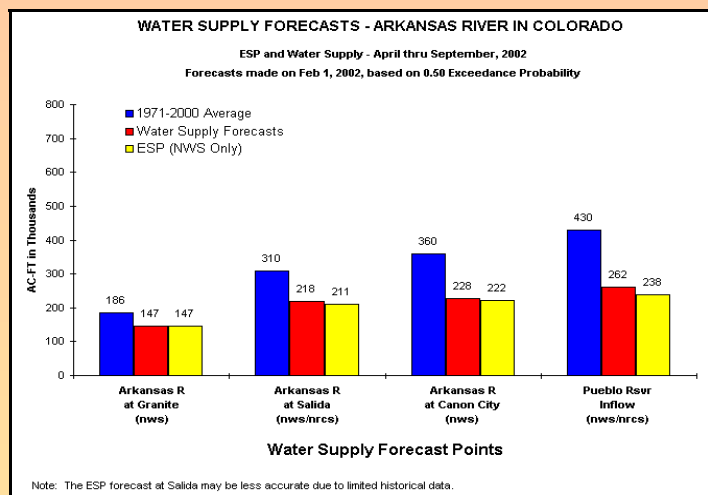


Figure 4. Arkansas River in Colorado ESP Forecast

The reservoir category contains only one graphic. It depicts the current reservoir capacity as percents of total capacity, percent of average, and percent of last year (at the same time period) for five reservoirs in the Upper Arkansas River basin. Figure 5 is an example of the February reservoir graphic.

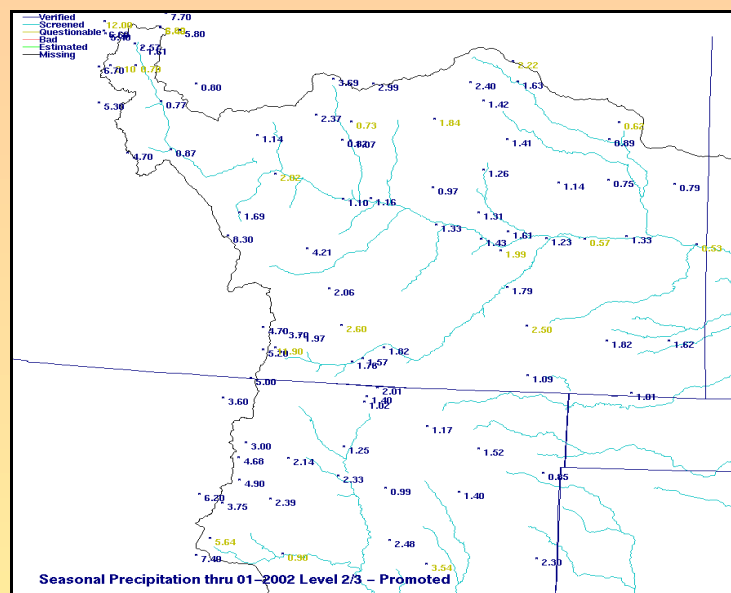


Figure 5. Arkansas River Reservoir Capacity

In the precipitation category, there are three distinct sets of graphics. Figure 6 is a depiction of the seasonal precipitation for

## An ABRFC Statistical Analysis of QPF

by Bill Lawrence

One of the most important inputs to a hydrologic model is the amount of precipitation that has fallen. In the past decade, River Forecast Centers (RFCs) across the country have begun adding forecast precipitation to their models. The term Quantitative Precipitation Forecast (QPF) is used to describe the areal extent and amount of precipitation expected in future periods. When the ABRFC began using QPF in its model, the 12 Weather Forecast Offices serviced by the ABRFC provided the QPF. In March of 2000, the ABRFC started using QPF based primarily upon guidance from the Hydrometeorological Prediction Center (HPC), located in Washington DC. The ABRFC currently includes 12 hours of QPF in all of its forecasts. As recently as the spring of 2000, the ABRFC used 24 hours of QPF in its forecasts. Since QPF can be a source of error in forecasts, it is important to determine if there are any obvious biases with these precipitation forecasts.

In order to determine if the QPF contains any systematic biases, the ABRFC undertook a study to compare 24-hour QPF against actual gridded rainfall estimates, or Quantitative Precipitation Estimates (QPE), derived by the Hydrometeorological Analysis and Support (HAS) unit of the ABRFC. Two methods of comparison were used. The first method involved comparing 24-hour QPEs ending at 12Z each day against the 12Z issuance of 24-hour QPF made the previous day, and is called the Standard Method. The second method compares 24-hour QPEs ending at 12Z each day against two 12-hour QPFs, the first 12 hours from the previous day's 12Z QPF, and the second 12 hours from the 00Z issuance of QPF. This method is referred to as the Update Method, since an updated QPF from the 00Z issuance is used.

Figure 7 (see below) indicates derived biases during the period when the HPC was the main guidance for QPF, June 2000 to December 2001. Bias of QPF is defined as the ratio of QPF to QPE. A ratio greater than 1.0 is a positive bias (indicating over-forecasting), while a ratio less than 1.0 indicates under-forecasting. As shown in figure 7, monthly biases tend to jump around quite a bit. An interesting fact is that the Update Method bias was higher than the Standard Method 15 out of 19 months. This is likely due to the fact that many forecasters tend to have more confidence in predicting precipitation for the first 12 hours of a forecast and that confidence results in over-forecasting. It also could be due to normal diurnal influences, with the occurrence of late afternoon and evening convection firing just before or after the 00Z QPF forecast issuance.

Perception at the ABRFC was that the QPFs would show a large positive bias. The average of all the monthly biases is in fact positive, but not nearly to the degree anticipated. Best-fit lines also indicate both the Standard and Update Methods' biases are decreasing toward 1.0. QPE estimates may also not be 100% accurate, with errors of +/- %5. Therefore, it can be said that the Standard Method has little, if any, bias while the Update Method has a slight positive bias.

Spatial biases were also noted across the ABRFC area. When looking at longer periods of time, this becomes more evident. Some of these spatial biases can be explained by small-scale topographic features, which likely enhance precipitation.

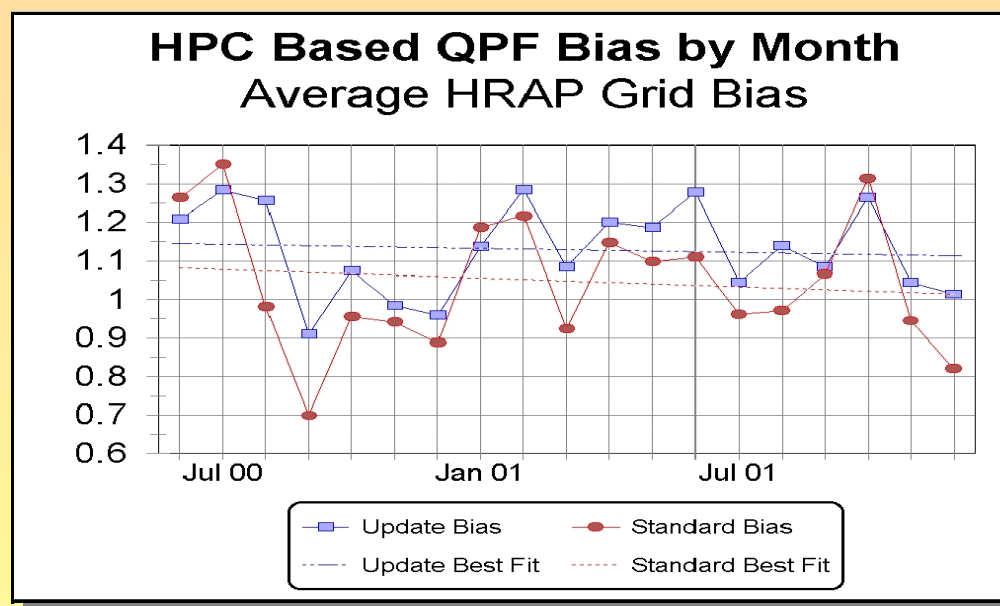


Figure 7. QPF biases for June 2000 to December 2001



Although a positive bias was computed by this study, the amount was below the perception of some ABRFC forecasters. Two important findings from this study were that Update Method of QPF tends to overforecast than Standard Method; and that there are defined topographic features within the ABRFC that tend to enhance precipitation more than is normally forecast. With this knowledge in hand, forecasters will hopefully be able to improve their future precipitation forecasts.

## **Know Our WFOs : Wichita, Kansas WFO**

*By Janet McCormick*

**T**he Wichita Weather Forecast Office is one of the 13 WFOs within the ABRFC's area of responsibility. The ABRFC is responsible for river forecasts at 34 points in the Arkansas River basin while the Missouri Basin River Forecast Center (MBRFC) in Pleasant Hill, Mo. monitors 11 points in the Kansas River basin. This area is subject to frequent devastating floods with rapid responding rivers, but usually of short duration. During the past 80 years, 66 separate flood events have been recorded on the Arkansas River at Arkansas City.

Major hydrologic features in the western half of the area are the Arkansas River and its tributaries from Great Bend to Arkansas City, including the Little Arkansas, Walnut, and Ninnescah Rivers. Together, these rivers drain more than 11,000 square miles of central Kansas. Most flood control for this area consists of levees and diversions, but there is some flood storage provided by small Natural Resources Conservation Service (NRCS) dams in the Walnut River basin and two larger reservoirs: Cheney and El Dorado.



**Figure 8. Weather Forecast Office Wichita, KS  
Hydrologic Service Area**

(Source: <http://www.crh.noaa.gov/ict/ahps>)

Headwater areas for the Verdigris and Neosho Rivers are located in the eastern half of the area. Upstream portions of these basins contain significant flood control capacity, including NRCS structures and larger Corps of Engineers' reservoirs which help minimize the impacts of frequent low-level floods. However, most of the area downstream of John Redmond Dam is uncontrolled, subjecting it to more frequent and devastating flooding.

The highly variable climate of the Wichita WFO area can create frequent flooding, but extended droughts also occur. Figure 9 provides a display of mean monthly flows for the Arkansas River for two 20-year time spans plotted together with the mean monthly flows averaged over the past eighty years. During the most recent 20 years, periods of drought and above normal flows have been somewhat mixed. For the period 1996 to 2000, monthly flows were mostly above normal, but since early 2000 the flow trend is mostly below normal. Predictions for the duration of the current drought would not be highly accurate given the variability of similar periods in the past.

Wichita WFO Service Hydrologist, Marian Baker, identifies non-supported river gages and small basin urban flooding as some of the major forecasting challenges for her area. Recent improvements to assist in these areas in-

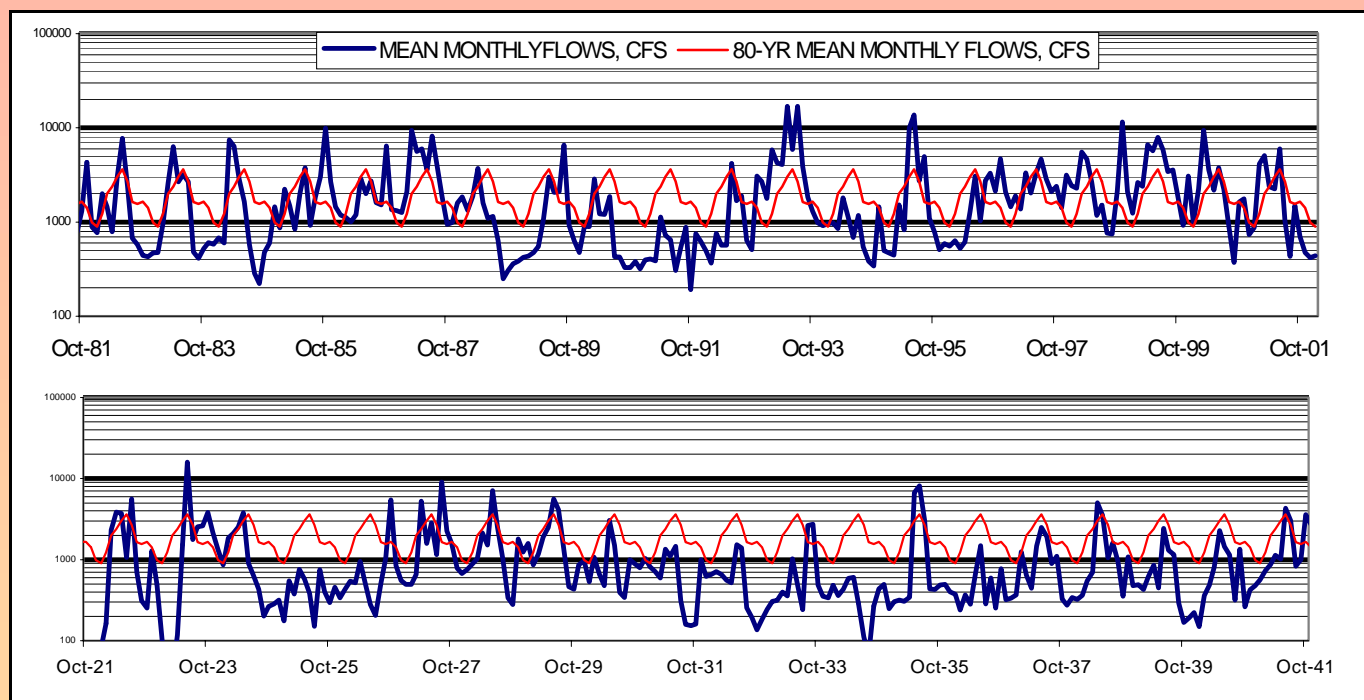


Figure 9. Mean Monthly Flows of Arkansas River at Arkansas City: 1921 to 1942 and 1981 to 2001

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*The GAGE* is a quarterly informational newsletter produced by the Arkansas-Red Basin River Forecast Center. Publications are also posted on our website at <http://www.srh.noaa.gov/abrffc>. To be notified via email of new publications, please send your email address to [diane.innes@noaa.gov](mailto:diane.innes@noaa.gov) with "subscribe newsletter" in the subject portion of your message.

## Acronyms in this Edition

**ABRFC** – Arkansas-Red Basin River Forecast Center  
**AHPS** – Advanced Hydrologic Prediction Services  
**CWA** – County Warning Area  
**ESP** – Ensemble Streamflow Prediction  
**HAS** – Hydrometeorological Analysis and Support  
**HPC** – Hydrometeorological Analysis and Support

**MBRFC** – Missouri Basin River Forecast Center  
**NRCS** – Natural Resources Conservation Service  
**QPE** – Quantitative Precipitation Estimates  
**QPF** – Quantitative Precipitation Forecast  
**RFC** – River Forecast Center  
**WFO** – National Weather Service Forecast Office